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EPR of Yb3+ ions in Ba1-xLaxF 2+x mixed crystals

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Abstract

Electron paramagnetic resonance (EPR) spectra of impurity Yb3+ ions (about 0.1 at.%) in mixed crystals BaF2(1 - x) plus LaF 3(x;) have been investigated for different values of the concentration x at a frequency of about 9.5 GHz by both continuous-wave (CW) EPR and electron spin echo methods. A spectrum of trigonal symmetry with a complex hyperfine structure is observed in "pure" BaF2:Yb 3+ (x = 0). Upon admixture of small amounts of LaF3 (x = 0.001), additional EPR lines arise with intensities increasing with the increase of x up to 0.005. These lines are attributed to trigonal centers including two rare-earth ions and two compensating fluorine ions. A further increase of x results in a decrease of the total EPR spectrum intensity, and at x ≥ 0.05 the CW resonance becomes practically unobservable. This may be due to the formation of rare-earth ion clusters with paramagnetic Yb3+ ions occurring in domains with a disordered structure of surroundings resulting in very broad EPR lines, which cannot be registered by CW EPR. Indeed, very broad (not less than 1 kG) EPR lines were observed by the electron spin echo method for concentrations x ≥ 0.02.